NAIC-ID(RS)T-0380-95

NATIONAL AIR INTELLIGENCE CENTER

PRELIMINARY EXPLORATION OF EARLY WARNING AIRCRAFT COUNTERMEASURES

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HUMAN TRANSLATION

NAIC-ID(RS)T-0380-95 21 November 1995

MICROFICHE NR: 95C000716

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English pages: 5

Source: Yu Jing Ji Dui Kang Chu Jan; pp. 33-35

Country of origin: China
Translated by: SCITRAN
F33657-84-D-0165
Requester: NAIC/TAEC/Frank Scenna
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ABSTRACT This article makes a simple introduction and explanation with regard to the roles of early warning aircraft in modern warfare as well as their electronic equipment. It points out that countermeausres concerning early warning aircraft will be combined countermeasures. They include destruction of the fuselage of early warning aircraft as well as the use of electronic countermeasure equipment to carry out jamming. In order to achieve effective countermeasures against early warning aircraft, the author puts forward research work associated with 8 areas which should be developed, such as, active/passive combined detection systems, and so on.

KEY TERMS Early warning aircraft Early warning aircraft countermeasures Electronic countermeasures

GRAPHICS DISCLAIMER

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1 KEY ROLES IN MODERN WARFARE

No matter whether it is the Malvinas Islands naval war, the air war over the Becca Valley, or the Gulf War which seized the attention of the world, all clearly verified in practice that early warning aircraft play important roles in modern warfare.

1.1 After the active (radar) and passive (reconnaissance) detection equipment of early warning aircraft go aloft, they expand to a maximum extent the monitored range against defensive and offensive air space in a multiple threat environment (in particular, low altitude air space environment), strengthening command and control capabilities of ground command centers.

Due to influences from the curvature of the earth and electric wave propogation, effective ranges of ground low altitude monitoring radars are limited--only reaching 40-50km. Low altitude coverage areas are only a few thousand square km. However, after E-3A's go up to 9000m, it is then possible to discover low altitude targets at distances of a few hundred km. Low altitude coverage areas can enlarge to several hundred thousand square km. Speaking only in terms of low altitude coverage areas, one early warning aircraft is capable of providing as much as 20-30 minutes of precious warning time. In the same way, after passive detection equipment (for example, AN/ALR-59 or 73's installed on E-3B's) goes aloft, the radiation source acquisition range can be increased to reach out to 1000km. This is still 4 min earlier than the warning time provided by monitoring radars. At the same time, due to the fact that passive detection equipment is capable of acquiring various types of electromagnetic radiation signals within total air space, all direction, wide frequency bands, the instantaneous coverage range can reach 500 thousand square km--several hundred times larger than the instantaneous coverage ranges of monitoring radars. If passive and active detection equipment are combined together, then, it is not only possible to increase the detection capabilities of early warning aircraft as a whole. It is also possible, moreover, to increase the counter reconnaissance and counter jamming capabilities of active detection equipment as well as identification capabilities with regard to targets or radiation sources.

1.2 Early Warning Aircraft Organically Combine Together Such Electronic Equipment as Active and Passive Detection Equipment as Well as Signal Processing and Communications, Combining in One Such Functions as Early Warning, Intelligence, Communication, and Command

Early warning aircraft are not only an important component part of total theater C3I systems, in and of themselves, they are also a small C3I system. As a result, besides being able to detect invading aircraft, warships, and missiles, and, in conjunction with that, taking this information and transmiting it

to ground command centers, early warning aircraft are also capable of directly carrying out command, control, and coordiation with regard to various formations--for instance, E-3A simultanous tracking of 600 targets, handling of 300-400 individual targets, the identification of 200 targets, and the ability to guide up to a hundred aircraft to carry out the air war.

1.3 After Early Warning Aircraft Take Off, Maneuver Is Flexible, Very, Very Greatly Increasing the Survivability of Their Own Internal C3I Systems

Due to the causes discussed above, early warning aircraft have already become important component parts of modern air defense, operations command, and intelligence safeguards. They are one of the important factors in seizing the initiative and achieving victory in modern war. Computer simulations outside China clearly show that air defense systems equiped with early warning aircraft have air defense effectiveness capable of rising to 15-30 times that of air defense systems not equiped with early warning aircraft.

2 ELECTRONIC EQUIPMENT ON EARLY WARNING AIRCRAFT

Let us take E-3 early warning aircraft as an example. At the present time, E-3's are a type of aerial early warning and command aircraft with the strongest functions and the most complete equipment in the world. There are three models of E-3: A Model, B Model, and C Model. A models are the first type produced. The fuselage is basically the same as a Boeing 707-320B. However, it is strengthened. The electronic equipment on board is primarily 6 systems such as monitoring radars, identification friend or foe, navigation, communication, as well as digital transmission, data processing, data display and control, and so on. There are 9 multiple function control stations and internal auxilliary display devices.

Monitoring radar models are AN/APY-1 (the Westinghouse Co. specialized in the development of this system). They are S wave band pulse Doppler systems. When up to 9000m altitude, the vertical view distance on the ground is 400km. Opting for the use of computers to process signals, it is possible to simultaneously track 600 individual targets. It is capable of carrying out the identification, interpretation, range finding, altitude measurement, and speed measurement for 240 individual targets at the same time. The radar in question opts for the use of high pulse repetition frequency Doppler technology in order to eliminate the influence of ground or sea noise. In conjunction with this, use is made of quick frequency changes and extremely low side lobe antennas (-50dB) to counter strong electronic jamming.

The E-3A has the improvements below:

(1) In order to improve processing speed and internal storage capacity, use is made of computer 4IICC-2 models to replace 4IICC-2 models;

(2) Use is made of AN/APY2 model monitoring radars to replace APY-1's in order to increase monitoring capabilities of targets on the sea surface;

(3) AN/ALR-59 (or 73) electronic reconnaissance equipment was installed to give a passive detection capability, raising target identification capabilities. Besides this, there was also the added installation of strengthened wing points to make it possible to hang metal foil/infrared dispensers, self-defense jammers, as well as infrared countermeasure systems, and so on;

(4) In order to improve communications capabilities, counter jamming digital communications systems were added--JTIDS (Joint Tactical Information Distribution System)--deploying I model terminals;

(5) HF/VHF radio stations and counter jamming communications systems (Have Quick) increased to possess rapid counter jamming capabilities.

After improvements, E-3A's were equiped with such electronic equipment as active and passive detection equipment, identification friend or foe, navigation, communications and digital transmission, data processing, data display and control, as well as electronic jamming, and so on.

3 EARLY WARNING AIRCRAFT COUNTERMEASURES

With regard to early warning aircraft countermeasures, it is possible to conclude that destruction of air frames and the carrying out of jamming against their electronic equipment make them unable to operate normally. However, it should be pointed out that, if one wants to achieve the objectives discussed above, it is difficult:

(1) Early warning aircraft themselves possess a high level of maneuver capabilities--for example, E-3A activity radii can reach 1850km. At cruising speed, they are 886km. Practical ceiling is 1.2km. They are capable of flying 11.5 hours even without carrying out aerial refueling;

(2) In terms of tactical applications, early warning

aircraft operate in air space where they have air superiority. Enemy interceptors have difficulty approaching them. Moreover, early warning aircraft activity air space is selected at medium and high altitudes outside the effective range of enemy air defense weapons;

(3) Early warning aircraft are fitted with self-defense jamming equipment--for example, self-defense jammers, thin metal strip dispensers, as well as infrared countermeasures, and so on;

(4) Monitoring radars possess the capability to counter strong jamming--in particular, after organic combination with passive detection equipment, the antireconnaissance, antijamming capabilities achieve an even greater strengthening.

4 SUGGESTIONS RELATING TO STRENGTHENING RESEARCH IN THE AREA OF EFFECTIVE COUNTERMEASURES CARRIED OUT AGAINST EARLY WARNING AIRCRAFT

From this, it is possible to see that, if one wants to carry out effective countermeasures with regard to early warning aircraft, it is necessary to advance research on specialized topics. In reality, in order to cope with the early warning aircraft of the Soviet Union, the U.S. early on set up an anti early warning aircraft project, developing anti early warning aircraft systems--the longe range passive positioning system (LRPLS)--and anti early warning missiles (for instance, the advanced strategic aerial launch missile ASALM).

It is suggested to launch research with regard to countering early warning aircraft in the areas below:

(1) Establish passive and active combined detection systems in order to resolve the discovery, identification, and precise positioning of early warning aircraft;

(2) Launch research on ground (ship) to air and air to air anti early warning medium and long range missiles, antiradiation missiles, and aircraft launched rocket boosted high altitude high speed unmanned craft in order to attack and destroy early warning aircraft;

(3) Launch research with regard to early warning aircraft identification friend or foe countermeasures technology. Clearly, it is only after the mastering of this technology, that it is then possible to make the aircraft and missiles of one side approach the early warning aircraft of the other side and carry out attacks or destruction;

(4) Develop research on early warning aircraft monitoring radar countermeasures technology. This must seek out effective countermeasure technology with regard to pulse Doppler system radars possessing quick frequency changes and extremely low side lobes;

(5) Develop research with regard to early warning aircraft navigation systems--in particular, GPS countermeasures--to make there be no way to provide precise location, speed, and time information, also simply destroying normal early warning aircraft operations;

(6) Launch research with regard to early warning aircraft communications and digital transmission countermeasures. What is pressing in this matter is the need to develop as quickly as possible research with regard to JTIDS countermeasures;

(7) Launch research on computer countermeasures. It has already been pointed out above that early warning aircraft are an important constituent part of theater C3I systems as a whole. Moreover, they are, in and of themselves, also a small C3I system. All these functions are completely inseparable from computers. If, through effective computer countermeasure means, computers are made to lose their effectiveness or be unable to operate normally, normal early warning aircraft operations have then also simply been destroyed;

(8) Develop research on infrared countermeasures technology.

Summarizing what has been discussed above, early warning aircraft countermeasures are combined countermeasures and an important systems engineering problem.

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